

# American Potato Journal

Volume XIV

July, 1937

Number 7

## BLIGHT IMMUNE, DROUGHT TOLERANT POTATOES

DONALD REDDICK

*Cornell University, Ithaca, N. Y.*

In work of the past several years it has been determined that immunity to blight, caused by *Phytophthora infestans*, is a heritable character. The blight immune parents used in this work have been species of *Solanum* from Mexico, and in particular *Solanum demissum*. The latter species has at least two characters of commercial importance, namely immunity to blight and a foliage tolerance for cold of 4° or 5° F. Many other characters of *S. demissum* and of other species are distinctly non-commercial, e.g., very long stolons, small tubers, a highly developed tendency to form tubers only with short days, and so forth.

The problem of producing a blight immune potato of commercial value is complicated, not only by the numerous undesirable characters of the immune parents, but also by sterility and incompatibility which make it difficult to produce hybrids at all and seemingly more difficult to secure crosses with desirable existing types. For example, *Solanum demissum* is very fertile and produces seeds in abundance, but, on the one hand, attempts to produce hybrids with commercial varieties have almost invariably failed when *demissum* pollen has been used, and on the other hand, pollen of the commercial varieties is largely aborted or sterile so that no crosses are effected. Such failures in interspecific crosses with *demissum* may be explained on the basis of chromosome difference, but such an explanation will not apply in the case of *S. antipoviczii* which has the same number of chromosomes (48) as the commercial varieties. It appears that the failures are largely attributable to pollen sterility because the species usually are receptive of pollen from plants which have been found to have fertile pollen. But the failure to secure seeds with pollen from the species in the reciprocal cross will have to be explained, for the present, by the use of that convenient expression, "incompatibility".

Various attempts have been made to find the conditions which favor the production of pollen in the horticultural varieties for it is well known that seed balls are often encountered in the field of pure stands of such varieties as Green Mountain and Cobbler. These attempts have not met with material success. Green Mountain, Cobbler and many other varieties have failed under conditions which have yielded entirely satisfactory results in the use of pollen from the variety Ekishirazu. If any progress were to be made, it appeared that male parents would have to be used which produced viable pollen even though their horticultural characters were such as to exclude them from the commercial class. The appearance of Katahdin in recent years has materially altered this picture although it is too soon to know what the "get" of Katahdin is going to be.

Several years ago a widespread appeal was made for fertile varieties or seedlings regardless of commercial qualities. A generous response ensued and as a result many hybrids have been produced.

An examination of the conditions under which cross fertilization has been accomplished leads to the conclusion that an inherent capacity of a plant to produce mature, viable pollen is by long odds the most important factor in the successful execution of a potato-breeding program. This conclusion may seem too obvious to warrant specific mention. It is stated in this way merely to dispel a notion which is prevalent that special conditions are necessary for hybridization of the potato, and to lay the fault, when one exists, to the male apparatus more frequently than to that of the female. Cross fertilization occurs when the temperature is held at about 60° F. and the humidity is relatively high but it also occurs when temperatures reach 100° F. through parts of the day and the humidity is relatively low. Nor does it appear from the records that, within reasonable limits, external conditions affect materially the capacity of a plant to produce viable pollen.

Of the horticultural varieties tried as pollen parents, Ekishirazu, obtained from Ito in 1919, is best. A variety from the Vosges called locally Steintaler is nearly as good; Katahdin is first rate. Of the unnamed seedlings tried, Krantz' seedling 41-2-10-1 is by long odds the best pollen parent ever tested. Krantz' seedling 11-5-9 is equally as potent, but its "get" is low grade especially in respect of tuber characters. This, of course, is the objection to the use of untried seedlings in a breeding program. It takes many years to determine all the commercially important characters of a variety and the use of unknown and untried stocks is justified only because of the extremely limited

number of kinds which produce enough pollen to be of any use at all. Krantz' 41-2-10-1 has been used as a pollen parent in crosses with several species, and their progenies as far as a fifth backcross with the percentage of successes from a first trial averaging better than 50. The reciprocal cross, however, either with the species or any of the self-fertile backcrosses never has been effected. The Krantz seedling 41-2-10-1 is self-fertile and is receptive of pollen of Katahdin. It is such anomalies as this that make a "program" of potato breeding an impossibility. One may develop a program of work, but in the end he is likely to take what can be got and be thankful it was not less. As an example, it may be noted that Imperia, a leaf roll-resistant variety, yields very little good pollen and failures with it amount to perhaps 99 per cent. The occasional sets of seed, however, presumably justify the use of this variety as a pollen source especially as the same variety used at Ithaca as a female parent has made an even poorer record. Various other varieties and unnamed seedlings have proved moderately good as pollen parents. A seedling of Green Mountain produces a fair amount of viable pollen and in most respects is very much like its progenitor. Most unfortunately, it does not have the high resistance to "latent" (potato virus 16 of the international code) possessed by its parent and on this account has to be dropped from consideration. It is a retrograde in fact, because high resistance to "latent" amounting to passivity, is practically indispensable in a potato for North America or for any region where latent passives predominate. To introduce a "latent" susceptible variety because of blight immunity would be retrogression too, because, on the whole, "latent" is a more serious disease than blight.

A considerable number of blight immune hybrids have been produced which approximate existing types of commercial varieties in respect of the principal horticultural characters, particularly as relates to date of maturity, size and shape of tuber, and fleetness of eye. The quantities of tubers of such selections vary from a few pounds to a few hundred pounds. The innumerable other characters which are factors in the final decision to increase a particular selection for release to the public must await the production of larger quantities of stock in order to make yield tests, cooking tests and the like. It must await also those particular conditions which occur intermittently and which in the last analysis determine whether a new variety is a permanent addition to potato culture. For example, it is readily admitted by nearly every potato grower in western New York that he would prefer to grow the variety Green Mountain. He actually grows a potato of the Rural type. He does this because he has found

by experience that he is much more certain of a good crop in a hot dry year. In other words, Green Mountain has little drought tolerance and the Rurals possess a marked degree of drought tolerance.

During the summer of 1936 there was unusual opportunity at Ithaca, as well as in many other places, to obtain performance records of the blight immune selections and the assemblage of pollen producers when grown under exceptionally hot and dry conditions. First of all it was observed that plants grown under glass where the temperatures were consistently higher than in the open showed no ill effects of high temperatures as long as the water supply was ample. Katahdin under glass maintained its beautiful broad, flat leaves at temperatures reaching 100° to 110° for several hours each day for several successive days. In the field, where water was not available, Katahdin rolled from top to bottom and appeared to be more severely affected by drought than Green Mountain. Various seedlings, developed at Presque Isle, exhibited this same tendency in plantings at Ithaca and elsewhere. Of the Presque Isle seedlings observed, Houma was outstanding in its tolerance of drought, whereas Golden was so severely affected that it was considered a complete failure. Other varieties which exhibited drought tolerance were the Rurals, Ackersegen, Cairns (this name will be proposed to designate a seedling which never has been named, but which has been called Evergreen in earlier publications), Russet Burbank, White McCormick, a McCormick seedling (388-1), 3 seedlings from a lot of seeds supplied by Dr. Clark and labeled F<sub>1</sub>, Irish Cobbler X 24642 (Aroostook Wonder X Sutton's Flourball), 2 sibs from an F<sub>1</sub>, Imperia X Krantz' seedling 11-5-9, an unnamed variety obtained from H. C. Moore and said to be of South American origin, *Papa reynosa* from Chachopo, Andes of Merida, Venezuela, Pearl, Krantz' seedling 40-2-2, Gardner and Schmidt's seedling 130.5-24, five sibs of family TM (naturally fertilized Ella, although Ella itself was strongly rolled and burned), five sibs of family OU (F<sub>3</sub>, Number 9 X Steinthaler), three sibs of family PS (F<sub>2</sub>, Cairns X Ekishirazu), two sibs of QO (an inbred of a Mexican cultivated variety of the *andigenum* type), one lot of family TN (naturally fertilized Green Mountain), one lot of family TR (F<sub>2</sub>, Triumph X Steinthaler), six sibs of family TX (F<sub>2</sub>, Cairns X Ekishirazu), two sibs of family TZ (F<sub>2</sub>, Cairns X Ekishirazu). President, virus free from Salaman, exhibited a considerable tolerance to drought, but the same variety from Nova Scotia affected with the mosaic caused by potato virus 16 showed both rolling and burning of the foliage. It was most gratifying to find that Krantz' 41-2-10-1 fell in the class of drought tolerants, especially as this seed-

ling has been used so extensively in the hybridizations for the development of blight-immune plants.

A goodly number of clones in the blight-immune families could be recorded as drought tolerant. In looking over the parentage of the hybrids it appears that wherever one of the above varieties or seedlings has been used in the combination a good many of the offspring have approximately the tolerance of the drought-resistant parent. The proportion of these is larger than might be expected, but it is likely that the selection which has been practiced in former years was based in part, although perhaps unconsciously, on a tolerance of drought, even though dry weather had not been of sufficient duration to make drought tolerance strikingly conspicuous.

Unfortunately, the only blight immune species in the field in 1936 was *S. demissum*. This species is definitely drought tolerant, but it appears from the records that the tolerance of this parent has seldom carried through to the third or fourth backcross. This is not surprising because conscious selection for drought tolerance was not made in the first, or some of the successive generations; in fact, many of the crosses were made and the hybrids grown in the greenhouse where such tolerance could not have been observed.

#### DISCUSSION

The development of blight immune varieties of potatoes has not been an item of great interest outside a narrow zone. This zone, however, corresponds closely with the regions of surplus crop potatoes. Until recently the presence or absence of blight in these regions has been a factor second only to the weather in causing violent price fluctuations from year to year. It is considered that the elimination of the blight hazard represents one step towards the stabilization of the industry. Although the development of winter crop potatoes in southern states has altered the picture materially in respect of production for winter storage, the blight hazard has been thereby spread over a much greater range.

Although no varieties of blight immune potatoes are in commercial production, it now appears that this is only a matter of time and that the most important duty ahead is to make systematic tests of the hybrids for adaptability to field conditions and for culinary qualities. In case no existing selection meets the requirements, a method has been developed by which other blight immune seedlings can be produced in large number and from which suitable selections can be made.

The work here reported suggests the desirability of a very free interchange of new stocks for tests under the greatest possible num-



ber of conditions, and that the distribution of such stocks should be effected before any rigid selection has been practiced by any one. Krantz never has suggested in private correspondence or otherwise that the seedling which he has numbered 41-2-10-1 possesses a marked resistance to drought, nor that when used as a male parent it is most useful in breaking up extreme lateness. It is entirely possible that he has not had the opportunity to observe the former character nor occasion to find out about the latter. Pollen of Krantz' 41-2-10-1 and of Katahdin has been used repeatedly in pollenizing different flowers of the same immune plant. The records show that each is an excellent pollen source, but that Krantz' seedling has a far better "get" than does Katahdin. On the basis of its present record alone, Krantz' seedling 41-2-10-1 merits special attention on the part of the geneticist, especially as it appears to be in approximate homozygous condition in respect of a number of readily observable characters.

Furthermore, the drought-susceptibility of so many of the seedlings produced in Maine suggests that there has been no opportunity at Presque Isle to observe this reaction. It even suggests that the foundation stocks employed there have not been suitable for the production of varieties adapted to the drought zone of potato culture. Given some drought tolerance in the foundation stocks, it seems that chance alone should have yielded a higher proportion of tolerant seedlings. In its broader aspects it may at least suggest that Doctor Stuart made a mistake when he decided to move his potato breeding plots from western New York to Presque Isle. This, of course, is based on the assumption that drought tolerance in a variety of itself would not be inimical to production in those zones considered more favorable for potato production.

There has been nothing observed which would suggest that the heritability of drought tolerance is linked in any way with some undesirable character. If this should prove to be the case, the possibilities of certain species is worthy of serious consideration in this connection. Weberbauer collected a wild potato on the mountain called Morro Solar near Chorillos in Peru on August 21, 1910. This was described by Wittmack as *Solanum neoweberbaueri*. Weberbauer noted that this plant grows on rocks where no rain ever falls and where the entire moisture supply is obtained from dew. It would seem that the drought tolerance of *S. neoweberbaueri* should be very marked and that tests to determine the facts should be made. Certainly many of us would be more interested in foundation stocks from the dry coastal hills of South America, than in those from the ocean climate of the Chonos.

CULTURAL AND STORAGE RESEARCH WITH POTATOES  
DURING 1936<sup>1 2</sup>

E. V. HARDENBURG

*Cornell University, Ithaca, N. Y.*

Comparatively fewer research studies in the field of potato culture and storage were reported during the current year than in 1935. In briefly summarizing certain of these studies, no pretense is made that all of the published work even in this country is included. Apology is offered to those authors whose contributions may have escaped attention in this report. Culture and storage are here broadly applied and made to include such phases of potato research as ecology, seed, varieties, culture and storage.

## ECOLOGY

During the severe drought at the Glasnevin, Ireland Experiment Station, Murphy (12) observed various indications of desiccation in the growing potato crop. When the tubers were harvested he observed a goodly proportion of them to be soft from no other cause than lack of soil moisture. Some of these soft tubers, being immediately planted in moist soil for comparison with normal tubers from the same plot, were observed to absorb water and sprout at once. From this and later tests, he concluded that the rate of water up-take was a good index of the percentage of water lost by the tubers in the crop suffering from drought. He considers sprouting of these water-deficient tubers to be the natural accompaniment of their water absorption. The author describes ten types of tuber abnormalities, all caused by drought, namely: cracking, hollow-heart, prolongation, gemnation (second growth), chain-tuberization, independent tuber formation, premature sprouting, stem-end wilt, glassy end or jelly-end rot, and drought and heat necrosis. Certain of these are commonly associated, for instance, cracking and hollow-heart, softening and premature sprouting.

Bushnell (3) reported the results of four years of field experiments with potatoes on muck soil at the Muck Crops Experiment Farm in Hardin County, Ohio. Frost danger appeared to be the only handicap to commercial expansion of potato production on this type of

<sup>1</sup>Partial report of the Committee on Research of the Potato Association of America.

<sup>2</sup>Paper No. 155, Department of Vegetable Crops.

soil in Ohio. In seasons when there was no late killing frost in spring, the Rural varieties yielded as well, if not better than the Cobbler variety. Potash was the only fertilizer constituent that gave large yield increases in the fertilizer experiments. As a result, potash alone at the rate of 270 pounds actual  $K_2O$  per acre or 750 pounds of a 0-9-36 mixture is recommended. Three inches proved to be the most favorable planting depth. In a comparison of muck-grown with upland-grown Cobbler seed potatoes, the muck-grown stock proved very satisfactory in two out of three years when used in Southern Ohio.

### SEED

Anderson (1) described four types of abnormality occurring mainly in Brown Beauty and Perfect Peachblow varieties in the San Luis Valley; these being (1) Wilding (2) Pearl type (3) Ragged giant hill and (4) Pinto. These abnormalities usually affect both the foliage and the tubers, the latter being either reduced in size or adversely affected in smoothness or quality. Wilding may be the same as "witches' broom". The author's review of literature, as well as his study of field performance and chromosome number, failed to show that any of these troubles are of the nature of virus diseases although all are transmitted through the tubers. Similarly, none of them appears to be due to mutation arising from change in chromosome number. For the present, control consists mainly in field roguing.

During the past year Butler (4) of New Hampshire has once more questioned whether tuber lines of seed selected from a healthy vigorous stock of potatoes may be expected to yield profitable results. He grew succeeding generations from single uniform seed pieces under controlled greenhouse environment to determine their comparative rank in yield and tuber-set from generation to generation. Finding that any one tuber-line may rank first in yield in one generation and last in some succeeding generation, he concluded that "to select seed from healthy stock on the basis of yield and tuber number is labor lost." Unfortunately, Butler did not indicate whether the stock from which he made his original selection was not already a tuber-line.

Davidson (5) reports rapid development of the seed potato industry on the bog soils of Athlone, Ireland. Seed produced on these black soils is increasing in favor compared with seed produced on mineral soils. The Early Rose variety has been grown here free from leaf roll for many years, because the aphid vector, *Myzus persicae*, is not very active under cool, moist soil conditions. Supervised seed



production since 1924 has developed an annual output of about 83,000 bushels from this area.

Lombard and Stuart (7) in an experiment conducted from 1931 to 1934 inclusive at Presque Isle, Maine, compared apical and basal potato seed pieces with respect to yield, stem number and tuber-set. Both Cobbler and Green Mountain varieties were used. Although plants from the apical sets emerged and blossomed first, the final yield averaged approximately the same as that from the basal sets. Statistical analysis showed that the small differences were not significant. The authors believe that the lack of consistency in previously reported results may be caused by faulty technique in setting up the experiment with the result that other variables were operative.

Stewart (13) at Geneva, N. Y., compared the yield results from apical with basal seed pieces depending on whether seed is cut before or after the tubers have sprouted. Although the yields in both cases were in favor of the apical pieces, the difference was large enough to be significant only when the seed was cut after it had sprouted. In the latter case, the difference in favor of the apical sets was 38.8 bushels to the acre or 14.2 per cent.

Miller and Denny (9) further reported on the use of ethylene chlorhydrin as a reagent to shorten the rest period of potato tubers. The experiment was designed to determine the minimum concentration necessary to break the rest period and the maximum concentration which could be tolerated without serious injury. It was found that as temperature was increased, the amount of vapor absorbed within a given time also increased. At 30°C., 15 cc. to less than 1 cc. of 0.1 molar solution per 100 grams of tubers was most effective, whereas at 25°C., 25 cc. to less than 0.1 cc. of the same concentration was satisfactory. Permeability of the skin of the tuber was found to vary the amount of ethylene chlorhydrin that would be absorbed within any given period of time. The authors recommend that the closed containers used in this treatment be filled not over one-half and that the amount of ethylene used be adjusted according to the quantity of tubers to be treated.

#### VARIETIES

Moore and Wheeler (11) tested the Katahdin variety in Michigan during 1931 to 1935. It matured about two weeks earlier than Russet Rural and frequently outyielded it. They found it well adapted to most sections of Michigan where it developed a good tuber type under hot dry conditions that often proved unfavorable to Russet

Rusal. Planted for early market, it generally exceeded Irish Cobbler in yield of marketable crop. It proved to be more susceptible to scab, leafhoppers, and flea beetles than Russet Rural.

### CULTURE

Brown (2) at the Connecticut Station reported the results of a five-year experiment comparing yields of potatoes grown in continuous culture with those grown in rotation with clover and timothy. The test was made on level loam soil high in organic matter. In three of the five years continuous culture gave yields approximately as high as the rotation culture. In the remaining two years which were abnormally dry, results favored rotation by 17 and 32 per cent. Brown concluded that a system which includes a sod-forming crop tends to reduce fluctuation in yields resulting from abnormal seasonal conditions and that clover and timothy are more satisfactory rotation crops than annual crops such as rye, soybeans and oats.

The results of a three years' experiment (1931-1933) to determine what may be best tillage practice in Aroostook County potato fields were reported by Lombard (6). Five different cultural treatments including a varying number of cultivations with and without pre-emergence tillage were compared. Since all plots were hand-hoed following the second cultivation, weed control was essentially no consideration in this experiment. His data indicated no significant difference in yield between pre-emergence tillage followed by one deep cultivation and pre-emergence tillage followed by five cultivations. The conclusion was that time and labor were wasted in cultivation beyond that necessary for weed control.

In a depth of planting experiment conducted at Houma, Baton Rouge, and Alexandria, Louisiana, for a period of three years, Miller and Kimbrough (10) report best results from the 4-inch depth. Two, three, four and five-inch depths were compared. The more shallow depths resulted in larger yields of No. 2 and No. 3 grade potatoes.

### STORAGE

With similar environmental conditions, it is well known that some varieties bloom profusely whereas others blossom only sparsely. Miller (8) of Louisiana reported that blossom production is influenced greatly by the length of the storage period between harvest and planting of the seed. He compared Louisiana spring-grown, fall-grown, and Northern-grown seed stocks of Triumph, Warba, Katah-

din, and Houma, with respect to blossom number. When these stocks were planted in February at Baton Rouge, the resulting plants apparently developed blooms in inverse proportion to the length of time the seed had been stored. Therefore he concluded that sparsely blooming varieties such as Triumph and Warba, when used for breeding purposes, can be better utilized by providing a shorter storage period.

## LITERATURE CITED

1. Anderson, Rudolph Daniel. 1936. A study of some abnormalities occurring in certain potato varieties in Colorado. Colorado Agr. Exp. Sta. Tech. Bul. 16.
2. Brown, B. A. 1936. Continuous culture versus rotation for potatoes. Amer. Potato Jour. 13, No. 11. November.
3. Bushnell, John. 1936. Experiments with potatoes on muck soil. Ohio Agr. Exp. Sta. Bul. 570. June.
4. Butler, O. 1936. Variations in yield of pure line Green Mountain potatoes grown in a controlled environment. Jour. Amer. Soc. Agron. 28: No. 9. September.
5. Davidson, W. D. 1936. Seed potatoes from bog land. Jour. Dept. of Agr. Ireland 34. No. 1. 48-52.
6. Lombard, P. M. 1936. Comparative influence of different tillage practices on yield of the Katahdin potato in Maine. Amer. Potato Jour. 13. No. 9.
7. Lombard, P. M. and Stuart, Wm. 1936. Relative vigor of apical and basal seed pieces of potato. Amer. Potato Jour. 13. No. 5.
8. Miller, Julian C. 1936. The effect of length of dormant period upon the subsequent flowering of the potato plant. Amer. Potato Jour. 13. No. 6.
9. Miller, Lawrence P. and Denny, F. E. 1936. Relation between quantity of ethylene chlorhydrin absorbed and growth response in treatments for shortening the rest period of potato tubers. Contrib. Boyce Thompson Inst. 8. No. 2.
10. Miller, Julian C. and Kimbrough, W. D. 1936. Irish potato investigations. Louisiana Agr. Exp. Sta. Bul. 272. January.
11. Moore, H. C. and Wheeler, E. J. 1936. The Katahdin potato in Michigan. Michigan Spec. Bul. 271. June.
12. Murphy, Paul A. 1936. Some effects of drought on potato tubers. Empire Jour. Expt'l Agr. (London) 4. No. 15, 230-246.
13. Stewart, F. C. 1936. The relative vigor and productivity of potato plants from basal and apical sets cut from tubers in different stages of sprouting. New York (Geneva) Agr. Exp. Sta. Bul. 658.

## ARMILLARIA DRY ROT OF POTATO TUBERS IN BRITISH COLUMBIA<sup>1</sup>

WALTER JONES, *Assistant Plant Pathologist, and H. S. MacLeod,  
District Inspector, Dominion Laboratory of Plant Pathology,  
Saanichton, British Columbia, Canada*

A dry rot of potato tubers caused by *Armillaria mellea* Vahl ex Fr. was reported from Australia in 1910 by Johnson (1) and from Washington State in 1914 by Bailey (2). It was first observed in

<sup>1</sup>Contribution No. 473 from the Division of Botany, Experimental Farms Branch, Department of Agriculture, Ottawa, Canada.

British Columbia in 1934 in three districts where the Netted Gem, Burbank, and Green Mountain varieties were grown on land which had been recently cleared of tree growth. In general, the percentage of affected tubers is small. In 1936, however, one grower in the Fraser Valley district lost about one half ton of Green Mountain tubers from an area of approximately one and one half acres. To date the disease has been found only among the Netted Gem, Burbank, and Green Mountain varieties.

The symptoms are visible on the outer surface of the tubers as hard, brown, roughened, shrunken areas which vary in size and are somewhat corky in texture. Dark brown to black rhizomorphs are generally attached to these areas and these may also be found adhering to the skin at various points. The rot is usually shallow, but in several Green Mountain tubers collected, the diseased tissue extended into the medulla, (figure 1). Tubers showing these symptoms were almost a total loss. The diseased tissue in the internal areas is light brown in color and interspersed with somewhat convoluted white mycelial plates with dark brown peripheries.



FIGURE 1—*ARMILLARIA* DRY ROT OF GREEN MOUNTAIN POTATO TUBERS

The losses caused by this disease have been negligible in most potato growing districts, and on the whole it is not considered a serious disease. It may, however, be advisable to avoid growing potatoes on newly cleared land where the sporophores and rhizomorphs of the fungus are abundant. On land of this nature the practice of planting

potatoes as a preparatory crop for tree or bush fruit should be avoided. Potato tubers are apparently well suited for the increase of the rhizomorphs of this parasite in the soil.

#### LITERATURE CITED

1. Johnson, T. H. 1910. Notes on a fungus found destroying potatoes. *Agr. Gaz. N. S. W.* 21: 563-566 and 699-701.
2. Bailey, F. D. 1914. Notes on potato diseases found in the Northwest. *Phytopath.* 4: 321-323.

---

### THE CULTIVATION OF THE POTATO IN PAMIR<sup>1</sup>

R. L. PERLOVA

*Institute of Plant Industry, Leningrad, U. S. S. R.*

Pamir forms a part of the autonomous mountainous Badakhshan region of the Tadzhik Republic of U. S. S. R., situated between 36° and 38° of north latitude and 73° and 75° of eastern longitude (Greenwich). Climatically and orographically it can be divided into Eastern and Western Pamir.

Eastern Pamir presents a multitude of wide lake basins and river valleys, situated at 4000 miles and more over sea level and surrounded by even slopes of high mountains often covered by eternal snows and glaciers. Its climate is severe and cold with the average annual temperature of 1° to 5° C. with few frostless days during the vegetative period, of approximately two to three months. There are only 60 mm. of annual precipitations. The soil is a gray-soil, characterized by eternal frost at the depth of 1-2 m. but according to the data of the two years working of the complex expedition of the Central Asiatic State University, these soils can be very well utilized for agricultural purposes under the condition of using suitable agrotechnical methods. Because of the severity of the climate the native Kirghizes do not occupy themselves with agriculture, but chiefly with stock farming.

The relief of Western Pamir is considerably intersected by rapidly flowing rivers. The climate is mild and warm (average annual temp. 9-10° C.). The vegetative period lasts about six months, being characterized by almost complete absence of frosts during the summer months. The soils are of the chestnut type. Eastern Pamir is the region of the old Iranian agriculture with primitive methods. Because of its insufficient precipitation (annual maximum of 180 mm.) it is irrigated.

---

<sup>1</sup>Translated into English by W. Reitz.



The potato was first introduced into Pamir by the Europeans about forty years ago but it has degenerated, giving only low yields with very small tubers. In the year 1926 all these potatoes were destroyed and have been supplanted by new ones introduced by a military "amateur" of agriculture from Orenburg, i. e., from a region with dry continental climate and consequently highly infected by virus diseases. No wonder, therefore, that the new potatoes about 1934, at the beginning of the work of the Central-Asiatic University Expedition, have been yielding only small tubers, not bigger than a walnut. The yield has also been very low, ranging from 100 to 200 grams for each plant.

The Institute of Plant Industry has chosen, from its collection, for the sake of the above-mentioned expedition, twenty different samples of potatoes. One part of the tubers was set in Porshnev, at the altitude of about 2000 m. above the sea, the other at Djaushangos at 3500 m.

The following results have been obtained. At Porshnev nearly all varieties of potato have proved high yielding, particularly Centifolia, Jubel, Cobbler, etc. 3-3.5 kilograms to the plant of big tubers to 600-700 grams weight). Under the severe conditions of Djaushangos the same varieties have yielded approximately 1 kilogram to each plant, having moreover proved exclusively frost-hard as to the green mass, up to 10° C.

Because of these interesting data the Institute of Plant Industry of U. S. S. R. sent to Pamir a large number of potatoes chosen from those collected by Prof. Vavilov, Dr. S. M. Bukasov and S. V. Juzepczuk in Central and South America, as well as some interspecific hybrids including thirty commercial varieties, obtained from crossing South-American and European varieties. All these potatoes were grown in three different mountainous zones, viz: (1) Bulunkul, Eastern Pamir, 3900 m. s. m.—200 samples tested; (2) Djaushangos on the limit between Eastern and Western Pamir, 3500 m. s. m.—198 samples,—tested; (3) Dasht—(named in honor of Prof. Baranov), Western Pamir, 2300 m. s. m.—1600 samples have been tested, of which 1185 were sown by tubers,—the rest, by seed.

Bulunkul is situated in a cold region. In 1935 there had been only twenty frostless days at the end of July and the beginning of August. Eternal frost was confirmed at the depth of 1.5 m. Naturally we could not expect a normal development of the potato plants. The setting took place about the 4th of June. The first plants which ap-

peared on the 23d of June resisted frosts to 3° C. On the 17th of August all the plants which were 30 cm. above the ground, before blooming, perished at 12° C. But notwithstanding the fact that the plants had been growing only fifty-six days, they had formed tubers large as walnuts.

The climate of Djaushangos is also cold. During the vegetative period, 1935, there had been twenty-five frostless days, but the mean daily temperature of the atmosphere and the soil was higher than at Bulunkul.

There was no eternal soil frost. The setting took place on the 13th of May but the first plants did not appear until the 38th day, because of the minimal temperature about 13° C. on the soil surface at the end of May and the early part of June. With the beginning of warm frostless days, in the second half of July and the first of August, the plants began to bloom. The greatest part of the samples perished from frost at 7.9° C. On the 31st of August some of them, namely: *Solanum curtilobum*, *S. ajanhuiri* and others as well as the hybrids of *S. curtilobum* x *Villa Hermosa*, *S. curtilobum* x *Switez*, *Centifolia* x *S. demissum*, *EPICURE* x *S. demissum* perished. On the 10th of September the temperature was -9.3° C. The following high yielding varieties have been observed: *Centifolia*, approximately 545 grams; and Paul Wagner, nearly 450 grams to the plant. Even more prolific have been the hybrids *EPICURE* x *S. Chaucha* x *S. Bukasovii*, 698 grams; *EPICURE* x (*S. curtilobum* x *Deodara*), 685 grams to each plant. All the tubers were medium in size.

Much work was conducted at Dasht of Baranow where a warm dry climate and long vegetative period, existed from May to October. Some negative factors prevailed, such as: immature soil; absence of any manure and fertilizers; and very primitive field implements at our disposal, consisting of the wooden plough "Omatch," "Ketmen," etc. The setting took place from the 23d to the 25th of May. The first plants appeared after 14 days, on the 7th of June. One month after setting, the plants bloomed, and on the 31st of August they yielded berries.

The South American potatoes showed an increased fertility, as for instance, *S. Rybinii*, *S. curtilobum*, which in Leningrad, in humid conditions of sea climate, favorable for the formation of berries, seldom formed them by natural self-pollination, now proved self-fertile; *S. Vallis Mexici*, which never forms berries in Leningrad, formed a great number of them in Dasht-Baranoval, though the berries are seedless.

The cause of this increased fertility can not, as yet, be accounted for. It must be sought, in cytological peculiarities or physiological characters appearing in the potato under the influence of conditions prevalent in Pamir, such as low temperature, high insolation, increased influence of ultra-violet rays, irrigation, and the like.

The potato species which, when subjected to a long-day period, formed none or very few tubers in Leningrad, formed many when grown in Dasht.

The wild species comprise *S. edinense* and *S. Vallis Mexici*; the primitive cultivated species, *S. Juzepczukii*, *S. goniocalyx*, *S. chaucha*, and *S. andigenum* (*F. caiceda*, *F. lecke-uma*, etc.). The latter ones proved prolific; for instance, *F. caiceda* yielded from 400 grams, *lecke-uma* to 550 grams to each plant. The samples of our South American collection which form rather few tubers under the conditions of Leningrad, have proved very high yielding at Dasht, Baranov: *S. mamilliferum*, 1330 grams; *S. Rybinii*, 1230 grams; *S. andigenum*, *F. Lima*, 1390 grams to the plant, etc. The interspecific hybrids and European varieties have proved exclusively high-yielding. Epicure x (*S. curtilobum* x *Pepo*), 2300 grams, Jubel x *S. andigenum*, *F. tocanum*, 3105 grams to each plant. Among the commercial varieties *Centifolia* has won the record in Western Pamir with approximately 3.5 kilograms to each plant. Korenevsky, Great Scot, Schenkendorf, Alma and others also gave high yields.

The excellent formation of tubers and the high yields may be explained by two factors: (1) That the presence of a short-day is favorable for the formation of tubers, particularly the South-American potatoes; (2) The peculiarities of photosynthesis in Pamir, manifesting itself in the increase of day assimilation and the decrease of night dissimulation, results in increased assimilation and low consumption of dry matter which certainly stimulate high yields.

The starch content data obtained were similar to the mean percentages characteristic for Leningrad.

#### LITERATURE CITED

1. A. Raikova. (1931). The climate and plants of Pamir.

SOME FACTORS AFFECTING CULINARY QUALITY  
OF POTATOES<sup>1</sup>

ORA SMITH

*Department of Vegetable Crops, Cornell University, Ithaca, N. Y.*

The problem of poor culinary quality of some of the potato varieties grown in certain seasons and in various parts of the country is becoming increasingly acute and of great importance to the growers and consumers. A comprehensive study of the factors affecting the chemical composition and culinary quality of potato tubers has recently been undertaken at the Cornell University Agricultural Experiment Station. The principal phases of this work include the causes of blackening of cooked tubers, causes of sogginess, mealiness and sloughing of cooked potatoes. A brief discussion of the preliminary data with the Smooth Rural variety is submitted at this time.

## INFLUENCE OF SOIL REACTION ON CULINARY QUALITY

Potatoes were grown in soil reaction plots at Ithaca in a silty-clay loam soil with reactions of pH 4.80, 5.66, 6.80 and 7.92. When these tubers were boiled, unpeeled; and boiled, peeled, there was a decided tendency for those grown in the soil of low pH to retain their shape better and to slough and break up to a lesser extent than tubers which had been grown in less acid soils or in alkaline soils. When they were steamed, however, there was no appreciable difference in the form of the tubers regardless of the reaction of the soil in which they had been grown. Likewise, there is little difference in texture of tubers grown at the various soil reactions.

Boiled and steamed tubers which have been grown at a soil reaction of pH 7.92 are usually more attractive in color than those grown at a lower pH. Tubers grown at this reaction are cream-like or yellowish in color, but do not turn gray or darken so extensively as those grown in the acid soils. None of the tubers, however, regardless of the soil reaction blackened very appreciably. Tottingham, Nagy and Ross (2) have found that the available potash in the soil may have an influence on the degree and prevalence of blackening of the tubers. During the growing season soluble potassium was determined in the present experiments by the Morgan (1) test. The available potassium in the

<sup>1</sup>Presented as paper no. 157, Department of Vegetable Crops, Cornell University.

soil of all these plots was apparently very low. None of the soils contained sufficient potash to enable a reading at the lowest amount shown on the chart namely 150 pounds to the acre. By estimating the slight turbidity shown it appeared that the soil of pH 5.65 contained the least potassium and soil with a pH of 7.92 the most. All of these plots have had annual applications for the past eight years of 1000 pounds of 5-10-5 fertilizer. Tottingham and his co-workers (2) have found a relationship between percentage of potash in the tuber and its tendency to blacken. It appears that at levels below 1.8 per cent  $K_2O$  in the dry matter there is large probability of the tubers blackening after cooking. Although the soil in which the tubers were grown in the present experiments was very low in available potash the analysis of the tubers shows that they contained an abundance of potash. Tubers which had been harvested from each of the soil reaction plots previously mentioned, on the 4th of August, the 24th of August, the 16th of September and 10th of October had at least 2.48 per cent  $K_2O$  in the dry matter. There appeared to be no correlation between the content of  $K_2O$  in the tuber and its tendency to blacken. This may be caused, however, by the high percentage of  $K_2O$  in all samples and to the extremely small amount of blackening in them.

Tubers which had been grown in these same plots in 1935 and stored at 40° F. for thirteen months still showed little tendency to blacken. None of the tubers grown at a pH of 7.9 or above blackened after this long storage period and those grown at a lower pH discolored only slightly. All samples, however, became sweeter, lost their mealy consistency, and became quite soggy.

When harvested immature on the 16th of September the mealiest tubers were those which had been grown at a pH of 6.80, although these tubers also sloughed more when boiled. None of the tubers darkened to any great extent although the whitest tubers were grown in soil at a pH of 6.80 and 7.92.

#### EFFECT OF POTASSIUM, NITROGEN, MOISTURE AND TEMPERATURE ON CULINARY QUALITY

Potatoes were grown in large boxes of unwashed, sandy soil in a low state of fertility to which sufficient phosphorus was added to support large vigorous plants. Sodium nitrate, muriate of potash and water were added or withheld from these boxes so that high and low planes of potash, high and low planes of nitrates, and high and low water content of the soil were maintained. One set of plants was



grown in the greenhouse during the summer at very high temperatures, whereas the other set was grown between the houses at a considerably lower temperature.

None of the tubers grown under any of the above combination of treatments darkened after cooking when subjected to any of the cooking methods employed. Although these experiments are preliminary to more extensive tests to follow the results indicate that whether grown at the high temperature or at the lower temperature the mealiest tubers, and those which maintain their form without breaking apart or sloughing, are those grown in soils with a low supply of potassium, high nitrates and a high moisture supply. The next best sample of tubers was grown in soil also low in potassium, high in nitrogen but with a low moisture supply.

#### INFLUENCE OF SPRAYING WITH BORDEAUX MIXTURE ON CULINARY QUALITY

The tubers were harvested when immature, in September and in October when the vines were dead. A comparison was made between unsprayed plants, those sprayed with 5-5-50 Bordeaux and those sprayed with the high to low Bordeaux recommended in several sections of New York State. Tubers from each of these treatments were boiled, steamed and baked and judged for quality. These preliminary data indicate that there is little, if any, difference in tendency to break apart or slough off in the tubers of the various treatments. There also is little difference in the mealiness of tubers, although there is a slight indication that the sprayed tubers are somewhat more mealy in texture than the unsprayed. There is also an indication that sprayed plants produce tubers which do not darken so extensively as those which have not been sprayed. The baked potatoes from plants sprayed with the high to low Bordeaux did not darken, whereas those sprayed with the 5-5-50 Bordeaux as well as those from the unsprayed plants turned gray to dark in color.

To determine whether culinary quality is influenced by extreme drought and high temperature during the growing season or low state of soil fertility, potatoes of the same seed stock were grown in two sections of Western New York. In one location they were grown in soil which had been in alfalfa sod for seven years and to which no fertilizer had been added for, at least, that same period of time. Adjacent to these plots, others were fertilized at the rate of 800 pounds of 5-10-5 fertilizer to the acre. The growing season temperature was extremely

high and the rainfall almost negligible. In the other location, plants were grown in soil fertilized at the rate of 1200 pounds of 5-10-5 fertilizer to the acre. The temperature during the growing season was lower and the rainfall, although deficient, was higher than that of the above location.

Tubers grown in soil fertilized at the rate of 1200 pounds to the acre, at the lower temperatures and higher soil moisture, were mealy, sloughed slightly and darkened at the stem end, whereas those grown under the very hot and extremely dry conditions were slightly mealy to soggy, remained intact with no sloughing and did not darken under any of the cooking methods. Not the slightest difference in form, texture or color could be detected between those grown in the same location but with and without fertilizer.

Samples of tubers from each of the treatments discussed in this paper have been obtained for chemical analyses in an effort to correlate chemical composition with the cooking qualities of the tubers.

#### LITERATURE CITED

1. Mader, E. O. and Mary T. Mader 1937. The composition of tubers of sprayed and unsprayed potato plants in relation to cooking quality. *Am. Potato Jour.* 14:56-59.
2. Morgan, M. F. 1935. The universal soil testing system. *Conn. Agr. Exp. Sta. Bul.* 372.
3. Tottingham, W. E., Nagy, Rudolph and Ross, A. Frank. 1936. The problem of causes of blackening in cooked potatoes. *Amer. Potato Jour.* 13:297-309.

---

#### SECTIONAL NOTES

##### COLORADO

The acreage of certified seed potatoes will exceed that of last year. It is not possible to give the exact acreage at this time as inspections have not yet started and applications have not been filed. The first inspection will start in San Luis Valley on the 12th of July. The outlook for the crop this year, in general, is not so favorable as last year. Poor stands, in general, are reported for the San Luis Valley largely as the result of a cold period that occurred about the first of June. The San Luis Valley has more water this year than at any time since 1930 and many growers have evidently forgotten how to handle it. Many fields are too wet resulting in a rotting of the seed pieces. The outlook at Greeley is not very favorable either, as the weather has been extremely hot and water is not very plentiful in this district. More flea beetles are also present this year and at present it appears that three

spraying will be necessary to obtain adequate control. The Colorado potato beetles also seem more numerous on the eastern slope. The damage from psyllids is more severe, at present, than in past years. This might possibly be caused by the lateness of the season. However, there is still plenty of time for this pest to appear. (July 12).—C. H. METZGER.

#### INDIANA

Harvesting operations are beginning for the early crop in central and southern Indiana. The yields are surprisingly good this year, the indications are that it will be from 50 to 75 bushels above the average.

Practically all the late potatoes will be planted by the 15th and conditions to date are very favorable for good yields.

The leafhoppers have caused considerable damage to the poorly sprayed fields and especially to the Triumphs. (July 7).—W. B. WARD.

#### KENTUCKY

The condition of potatoes, generally, is good, but the yield is not in keeping with the splendid growth of vines. Digging has begun here and there, several cars having moved at \$1.20 per hundred-weight with the probability that the price will shortly go lower. Gardeners in populous sections are selling to stores at \$1.00 a bushel. This is slightly better than the price growers are paid for shipped-in potatoes, since newly-dug, home-grown potatoes have a better appearance. It is too early to anticipate yields. (July 7).—JOHN S. GARDNER.

#### MASSACHUSETTS

The potato crop is progressing normally in Massachusetts. Approximately six inches of rainfall have fallen during the months of May and June, which has made weed control slightly difficult.

Presumably the acreage planted this year is similar to last year, although according to a recent survey of the Connecticut Valley Counties, there is a slight decrease compared with last season,—the additional acreage having been planted to tobacco. (July 13).—RALPH W. DONALDSON.

#### MINNESOTA

Potato planting this year was conducted over a longer period of time than is usually the case, because of excessive rains in some of the bigger potato growing areas during the normal planting time.

In the sandy land area, north of the Twin Cities, planting conditions

were ideal and until the 1st of July, sufficient rainfall had occurred to cause the crop to grow nicely. During the last six years the growers in this area have suffered because of extreme heat and drought during the period of tuber formation. We are now passing through a similar period although it has not been so severe as was the case the past three years. During these drought years there has been an increasing interest in the possibilities of irrigation and many of the market gardeners have been growing garden produce, including potatoes under irrigation, with highly satisfactory results. Those who largely depend on potatoes for a livelihood are commencing to put in irrigation systems. This year one grower in the Grooklyn Center area, north of Minneapolis, is irrigating 65 acres of potatoes with an elaborate system.

All of the non-irrigated fields are beginning to show the effects of the heat and drought whereas the irrigated fields have excellent crops coming on, and are in very good condition at the present time. In fact, some of these growers have potatoes of fine quality already starting.

Although planting was somewhat delayed in the Red River Valley Section and the Arrowhead area because of excessive rains nearly all the fields were planted by the 1st of June. Growing conditions have been very good and it appears that the growers in both these regions will harvest a much better crop this year than they did in 1936.

Planting on the peat bogs was also delayed because of excessive rains, and in some instances rains occurring after planting caused considerable damage.

Prospects for a good crop of potatoes, in general, are much more promising at this time than they were a year ago. (July 13).—A. G. TOLAAS.

From the 3d to the 7th of August the Red River Valley Potato tour will be held. This tour will be held in Becker, Wilkin and Clay Counties on the 3d and 4th of August; in Norman County, on the 5th of August; in West Polk on the 6th of August; and in East Polk County on the 7th of August. The county agent in each of these counties is conducting one or more seed source test plots in an endeavor to bring out the value of seed stock produced in isolated areas. Considerable time will be spent on the tour examining these plots.

On the 12th, 13th, and 14th of August, the Arrowhead potato tour including the 4th annual potato field day at the Grand Rapids Sub-Station will take place. Most of the fields in the Arrowhead Section are small and isolated from one another. It is in this region where

considerable progress has been made in producing Irish Cobblers, foundation stock.

Interest in the Annual field day at the North Central Experiment Station has increased each year since its inception. Since it is located in the heart of the Arrowhead region, this station is conducting various experiments and demonstrations dealing with potato problems in the area that it serves. Here is also located one of the important testing grounds in connection with the potato breeding work, a major project conducted under the direction of the Division of Horticulture at the University Farm. (July 13).—A. G. TOLAAS.

#### MONTANA

There is a general acreage increase in the state as reported by the federal-state statistician, but although there has been an increase in planting this year the total acreage will still be below our average. The number of applicants applying for certification has been increased slightly this year as well as the total acreage.

Growing conditions during June and the first few days of July have been very good throughout the state.

The moisture situation in the state is fair, in general, with the exception of the northeastern part. Potatoes planted on good summer fallow in the dry land areas have a chance to make a fair yield unless some unforeseen condition develops to reverse present prospects. (July 7).—E. E. ISAAC.

#### NEBRASKA

The potato situation in Nebraska has continued favorable since the first part of June. The dry land acres planted have been materially reduced, but all fields are in much better condition than a year ago. The stands are excellent and there will probably be plenty of moisture for two or three weeks without causing any damage to the crop.

The final acreage entered for certification will be between 75 and 80 per cent of the average, which has been in the neighborhood of 10,000 acres. Cobblers, which have averaged between 5 and 10 per cent of the total, will be reduced nearly one-half.

A small amount of early table stock will begin to move from the Scottsbluff section approximately the first of August, according to present indications. This volume is smaller than usual, but the quality should be very good.

Scattered reports of insect trouble have been called to our attention. It appears that the grasshoppers will be with us again in some sec-



tions, though probably not quite so severe as in 1936. The favorable factor regarding this matter is that the farmers are alert to the damage that may be done and have begun spreading poison and fighting the insect. Blister Beetles have been reported in scattered counties. Psyllids have been reported on the early irrigated plantings, and considerable spraying with Lime Sulphur has been done. This year many of the growers are preparing to control these insects by getting power spraying equipment. They recall the severe damage done by these insects during the season of 1934 and are determined to avoid it as much as possible.

Nothing definite can be given on marketing at this time, because both the buyers and growers are very reluctant to sell futures. Generally speaking Nebraska growers are reluctant to contract until the prospects for a crop materialize, which will probably be in early September. (July 13).—MARX KOEHNKE.

In general, the early potato crop in the North Platte Valley is in good condition. On several occasions temperatures have been too high for the best development of the potato plant. However, cool nights and a few periods of cool, cloudy weather have placed the crop in a nearly normal condition. Long periods of extremely high temperatures, such as occurred last year, have not prevailed this year, consequently the early crop is in much better condition. Colorado Potato Beetles have slightly menaced the crop, but have been controlled, in the majority of fields, by spraying. Purple top has not been serious to date, although psyllids have been found in some places. Present indications are that good yields will soon be harvested from the early crop.

The late crop of potatoes has emerged and very good stands are evident in most fields. Soil moisture has been favorable for germinating and establishing the plants, and it appears that sufficient irrigation water will be available to mature the crop. The acreage of late potatoes has been increased approximately twenty per cent above the acreage for last year. Nineteen hundred acres, under irrigation, have been planted to certified potatoes, and between twenty and twenty-five thousand to commercial potatoes in the North Platte Valley. (July 12).—LIONEL HARRIS.

#### NEW JERSEY

The extremely hot weather of a week ago resulted in the early maturity of many fields. It is important to note that well sprayed fields are still green. Instances have been observed this week where ap-

proximately 75 per cent of the leaves in unsprayed fields are dead as compared with 10 per cent for adjoining sprayed fields. Leafhoppers and flea beetles have been very severe and are largely responsible for the early maturity of the crop. Despite this fact, however, the crop in New Jersey promises to be good.

Scattered shipments of potatoes are already being made, largely to local markets. Car shipments will probably start within a week or ten days. (July 17).—W. H. MARTIN.

### NEW YORK

Owing to the fact that potato planting was delayed nearly two weeks in most upstate New York counties, it is still too early to evaluate the condition of the crop. The rainfall in June was one of the highest on record and not only the planting was hampered but subsequent weed control was rendered difficult. Potatoes that were planted before the middle of May are, generally speaking, in excellent condition. The Long Island crop prospect is excellent. Aphids have appeared in some sections and the extent of damage from this pest will hinge on the weather conditions during the next four weeks. A new trouble, tentatively described as purple top, has appeared in a few fields in Suffolk County. At present it is thought this may be caused by a deficiency of some mineral nutrient, although probably not potash.

The date for the summer field day of the Empire State Potato Club has been set for the 19th of August. Visitors from neighboring states will find this event one of profit as well as pleasure. It is to be held on the farm of Bruce Cottrell, of Homer, in Cortland County. The Cottrell farm is on Route 41, about 4 miles northwest of Homer. (July 9).

### OHIO

Irish Cobblers are now being harvested in southern Ohio. Growing conditions have been ideal and the yields will be the best that we have experienced for several years. The acreage is somewhat less than a year ago because of the damage from excessive rains. Several hundred acres were drowned on the muck; and smaller acreages, on low ground. Leafhoppers are numerous and have done considerable damage.

During May and June the heavy rains in northern Ohio delayed the planting of the late crop. Potatoes planted between rainy periods

show poor stands. Many of the late plantings were delayed until July. The heaviest rainfall recorded was thirteen inches in forty-eight hours.

The acreage will be reduced because of rotting seed and seed spoilage on account of delayed planting. A late fall will be needed, if Ohio is to have a fair yield of late potatoes. (July 13).—E. B. TUSSING.

#### PENNSYLVANIA

Our early potatoes, in general, promise a good crop but have been maturing rapidly during the hot weather of the past week. Moisture conditions have been good to over-abundant, with a few exceptions. The Cumberland Valley and Lancaster County have experienced a number of very heavy rain storms which have washed fields, packed the soil, and made weed control difficult. In some cases stands of late potatoes have been reduced by these storms, but, in general, the late-planted crops look well.

The next large potato event will be the 2-day summer gathering of the Potato Growers' Association at Hershey on the 28th and 29th of July. (July 12).—J. B. R. DICKEY.

Applications for seed potato certification are still being received. By the time the first inspection is completed we expect to have about 1200 acres under inspection. This acreage compares favorably with the 923 acres entered last year.

Nearly half the acreage to be inspected this year is planted with the Nittany variety which was developed by Dr. E. L. Nixon. This variety is finding considerable favor among our Pennsylvania growers. Reports have also been received from Maine, New York and Ohio, where it has been grown on a commercial basis, that it is now replacing the Irish Cobbler. Reports from several southern states have also been quite favorable.

Several years ago seed from the Nittany variety was sent to Maine for test purposes. The tubers harvested from these tests were propagated and this year we received several carloads of certified stock of this variety for commercial planting in Pennsylvania. The foliage of this variety is similar to that of the Irish Cobbler, but the tubers are very much smoother, with shallow eyes. It is our early variety and matures at approximately the same time as the Cobbler, and in many instances has given higher yields than the Irish Cobbler variety.

The trend away from the Russet Rural in Pennsylvania is still quite apparent. The acreage entered for certification this year includes, the following varieties: Nittany, approximately 500; Russet Rural and White Rurals combined, 500; Bliss Triumph, 35; Katahdin, 110; Irish Cobbler, 80; and several acres of Chippewa. Last year we certified only 198 acres of Bliss, Cobbler, Katahdin and Nittany combined, and 542 acres of the Russet Rural and White Rural varieties.

Stands are very good, although a few growers have reported poor stands of Katahdins. Several of the poor stands of this variety have been traced to poor cutting of the seed pieces. Several fields were examined which showed seed-pieces without any eyes.

Growing conditions, as a whole, have not been very favorable in most areas. A few small areas report a deficiency in rainfall, but in most of the state it has been too wet to develop a good crop of tubers. Vine growth is very good, but the tuber set is not heavy. Late Blight has also been reported. (July 14).—K. W. LAUER.

#### RHODE ISLAND

During the month of June Rhode Island experienced one of the longest periods of rainy weather on record. The result has been heavy top-growth on potatoes and considerable danger from late blight. Some late blight has already appeared. Otherwise, the crop looks promising. (July 12).—T. E. ODLAND.

#### WISCONSIN

We are not in possession of very complete information. However, scattering reports received at Madison indicate that there has been some damage to the crop in Wisconsin during the past ten days because of the high temperatures. There has also been a shortage of rain in some of the central and northern areas. We have received reports that insect infestation has been quite severe in some sections of the state. Although we believe the above conditions have not been general, there will, of course, be a decided reduction in the crop estimates for this period of the year in Wisconsin if these unsatisfactory conditions should continue. There is some prospect for a return to more favorable conditions, as this brief statement is being written. (July 13).—J. G. MILWARD.

## POTATO MEETINGS

August 3-7—Red River Valley Potato Tour, Minnesota. This tour will embrace the following counties: Becker, Wilkin, Clay, Norman and Polk.

July 28 and 29—Summer Meeting of Potato Association at Hershey, Pennsylvania.

August 12, 13 and 14—Arrowhead Potato Tour, Minnesota,—including the 4th annual potato field day at the Grand Rapids Sub-Station.

August 19—Summer Field Day of Empire State Club of New York, August 19. On farm of Bruce Cottrell of Homer, in Cortland County. The Cottrell farm is on Route 4, four miles northwest of Homer.

## ERRATUM

In the article by George C. Moore, in the June issue, the caption at the top of table 2 which read: "Effect of root pruning on growth of Smooth Rural potatoes and on ridge culture," should have read, "Relative increases in potato yields from irrigation on level and on ridge culture."

## REVIEW OF RECENT LITERATURE

**The status of potato production on muck soils in Ohio.** JOHN BUSHNELL. (*Ohio Agr. Exp. Sta. Bul.* 570 (1936) pp. 1-25).

There are about 100,000 acres of muck soils in Ohio suitable for cropping. About one-third is intensively cropped to vegetables, chiefly onions, celery, and carrots. The remainder is in field crops, or in small undeveloped tracts. Not more than 3,000 acres are planted in potatoes. Potato production on muck in Ohio is far behind the neighboring states of New York, Indiana, and Michigan.

The lag is partially caused by a market prejudice against muck-grown potatoes. Until recently few potatoes grown on muck in Ohio were unfertilized, unsprayed, frequently immature, and consequently of low quality. The crop was never adequately cleaned for market and the coating of muck on the tubers was a distinct mark of low quality. As long as these methods prevailed, potatoes were not so profitable as other vegetable crops.

It is only during the past five years that modern methods of growing and cleaning have been adopted in Ohio. As might be expected, the market prejudice has been gradually waning. During this same period, onion producers have had increasing difficulty in getting good stands on onions. Long-cultivated muck has become of such fine tex-



ture that it drifts with the wind, and onion seedlings are frequently either exposed or buried. The onion producers are therefore turning to potatoes as a crop that can be grown successfully on fine texture muck.

In 1932, at the time when a few of the Ohio growers were turning to modern methods of producing potatoes, a Muck Crops Experiment Farm was established on the Scioto Marsh, near McGuffey. In planning the initial experiments at this farm potatoes were given a prominent place. At the outset the aim of the experiments was to determine the possibilities and cultural methods of growing the crop on muck in Ohio. The results to date have been recently published in an Ohio Experiment Station Bulletin, Number 570.

As a whole, the potato crops at the Muck Crops Experiment Farm were very satisfactory. The plants grew more rapidly and the roots penetrated more deeply in the muck than those planted on mineral soils at other experiment farms. On most mineral soils in Ohio potato roots are largely confined to the plowed layer and penetrate the subsoil approximately five to ten inches, whereas in the muck experiments the roots extend to the bottom of the muck, thirty inches deep, and are abundant in the calcareous material at this depth.

The chief risk in growing potatoes on muck in Ohio, as elsewhere, is frost. At the Experiment Farm in two of the first four seasons the tops were killed by June frosts. Because of the risk of frost we advise delaying the planting of all varieties until approximately May 20. Cobblers are the most widely grown variety, and because of late planting they are not harvested until September. It is somewhat surprising that Cobblers planted in late May are able to survive Ohio's mid-summer heat.

On mineral soils Cobblers can only be grown as an early spring or late fall crop; if planted in late May the tops are always small and usually succumb when subjected to the heat of August. But at the Muck Farm, the Cobblers have been a most successful variety, irrespective of the time of planting.

In line with these findings at the Experiment Farm the acreage of potatoes on muck in Ohio is rapidly increasing. During the past five years the acreage has increased from practically nothing to approximately 3,000, mostly on tracts previously planted in onions. Numerous tracts suitable for potatoes are now planted to corn or pastured. As long as potatoes prove profitable, more and more of these tracts will probably be cropped to potatoes. The intensive vegetable crops are

not likely to be supplanted, unless, as in the case of onions, the soil becomes unsuited to these crops. Eventually, potatoes may occupy 25,000 to 30,000 acres of Ohio muck. (Author).

**Induced changes in respiration rates and time relations in the changes in internal factors.** L. P. MILLER, J. D. GUTHRIE AND F. E. DENNY. (*Contr. Boyce Thomp. Inst. Vol. 8, No. 1, (1936), pp. 41-61*).

Potato tubers were subjected to the vapor of various chemicals under conditions which were known either to increase or decrease the  $\text{CO}_2$  output and the time relations were determined in the changes resulting in respiration, pH, citric acid, glutathione, sugars, sulfate, catalase and peroxidase activity and methylene blue reducing power.

Treatments which increased the  $\text{CO}_2$  output also usually caused large increases in the sugar content but these increases did not occur until after the peak of the higher respiratory activity had passed. Ethyl alcohol which decreased the  $\text{CO}_2$  output either had little effect on the sugar content or brought about decreases. Catalase and peroxidase activity also were not directly connected with the changes in  $\text{CO}_2$  output. The chemicals which increased respiration brought about large increases in the activity of these enzymes but these changes followed rather than preceded or coincided with the changes in the  $\text{CO}_2$  output. Ethyl alcohol which decreased respiration increased catalase activity and decreased peroxidase activity.

The increase in the methylene blue reducing capacity of the juice that follows ethylene chlorhydrin or butyl halide treatments is not the cause of the increased respiration produced by these treatments.

The decrease in citric acid and the increase in pH begin at approximately the same time as the increase in respiration. Apparently citric acid is converted to  $\text{CO}_2$  in the rapidly respiring tissues and the pH increases as a consequence of the decrease in citric acid.

The large increase in glutathione that follows treatment with ethylene chlorhydrin is not the cause of the increase in respiration since it takes place 40 to 60 hours after the beginning of treatment, much later than the increase in respiration. Butyl halides, which produce a large increase in respiration, decrease the glutathione content, possibly by some direct action on glutathione.

The decrease in sulfate that follows treatment with ethylene chlorhydrin probably occurs about the same time as the increase in glutathione and may be caused by the utilization of sulfate in the synthesis of glutathione.—ORA SMITH.

# Ohio Superspray Hydrated Lime

FOR SPRAYING AND DUSTING

A 300 MESH HIGH MAGNESIUM HYDRATED LIME.  
WRITE FOR RESULTS. GREATER YIELDS, OBTAINED  
BY MAINE EXPERIMENT STATION, OHIO EXPERI-  
MENT STATION, Etc.

**OHIO HYDRATE & SUPPLY COMPANY**

WOODVILLE, OHIO

Manufacturers of various forms  
of lime and limestone products.

## WANTED

Back numbers of the Potato News Bulletin and the American  
Potato Journal.

All numbers of the Potato News Bulletin.

American Potato Journal Vol. 3; Vol. 4; Vol. 5, Nos. 3, 5, 6  
and 7; Vol. 6, Nos. 4 and 6; Vol. 7, Nos. 4 and 6; Vol. 8,  
Nos. 5, 6 and 7; Vol. 9, Nos. 4 and 6; Vol. 10, Nos. 4 and  
8; Vol. 12, No. 2.

Communicate with William H. Martin, New Jersey Agricul-  
tural Experiment Station, New Brunswick, N. J.

# American Potato Journal

PUBLISHED BY

THE POTATO ASSOCIATION OF AMERICA

SOMERVILLE, N. J. NEW BRUNSWICK, N. J.

## OFFICERS AND EXECUTIVE COMMITTEE

FRED H. BATEMAN, *President*.....York, Pennsylvania  
F. A. KRANTZ, *Vice-President*.....Univ. of Minnesota, St. Paul, Minnesota  
WM. H. MARTIN, *Sec.-Treas. Editor*....Agr. Exp. Sta., New Brunswick, New Jersey  
JULIAN C. MILLER.....Louisiana State University, Baton Rouge, Louisiana  
FRANK W. HUSSEY.....Presque Isle, Maine  
C. H. METZGER.....Colorado State College, Fort Collins, Colorado  
ORA SMITH.....Cornell University, Ithaca, New York

## ACREAGE STABILIZATION THROUGH CREDIT CONTROL

At the recent conference of vegetable and potato growers in Washington, D. C., the committee on credit recommended that, "As a means of curbing abuses resulting from speculative production financing, it is requested that immediate investigation be made into the possibility of regulating, by legislation, this type of financing."

Representatives from several southern states reported that ninety per cent or more of the potato acreage was financed by speculators who apparently were but little concerned with the growers' interests. These representatives insisted also that speculative production financing was mainly responsible for the large increase in the acreage planted in certain states this year and that it accounts for the extreme fluctuations in acreage from year to year. It will obviously be difficult to find a solution to this very perplexing problem. This, however, should not deter the proper authorities from making a sincere attempt, particularly since it has been suggested that ample authority for the regulation of this type of credit exists under the Packers' and Stock Yard Act and the Commodities Exchange Act.

It was also recommended at the Washington conference that, "such changes be made in the Soil Conservation Program as will make it applicable to vegetables and potatoes on a basis equivalent and comparable to other parts of the program such as tobacco, cotton and peanuts." Obviously, this is suggested as a means of stabilizing the potato acreage. If the situation, as regards speculative production continues to exist there is some question as to whether the proposed changes in the Soil Conservation Program would result in acreage control. It is assumed, of course, that the potato growers are interested in stabilizing the industry by preventing wide fluctuations in the acreage from year to year and not in the possibility of securing small sums from Government agencies. If this is true, some curb must be placed on speculative financing of planting if the years of feast and famine are to be averted.